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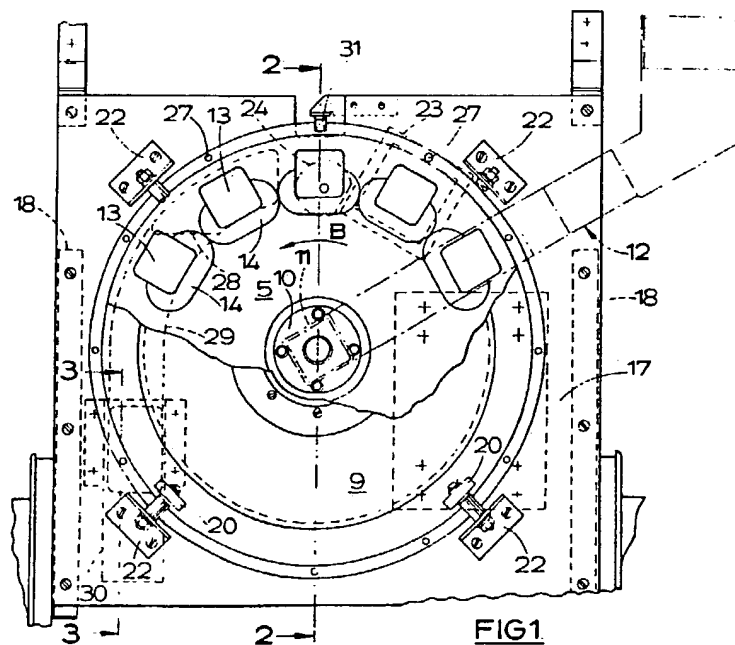
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Selected US specifications from IPC sub-class

G07D

(54) **Coin dispensers**

(57) A coin dispenser has a coin transport device, such as a coin transport disc (5), for carrying mixed coins in single file from a batch of coins in a hopper (1) past a sensor (23) of a coin discriminator and then past a coin selection station at which coins can be diverted back into the batch by an ejector (24) operated by a solenoid (26). An electronic control means determines which coins are allowed to pass to a coin outlet (30) in dependence upon the requirement for coins at the outlet and the denominations of the coins which are sensed by the sensor (23). In one mode the transport disc (5) is rotated but all coins are directed back to the batch by the ejector pin (25), in order to provide a statistical analysis of the mix of coins in the hopper from the readings of the discriminator (23). The coin dispenser can be used as a change giver or for dispensing winnings in a gaming machine. Alternatively, it can be linked to a coin sorter for batching coins.



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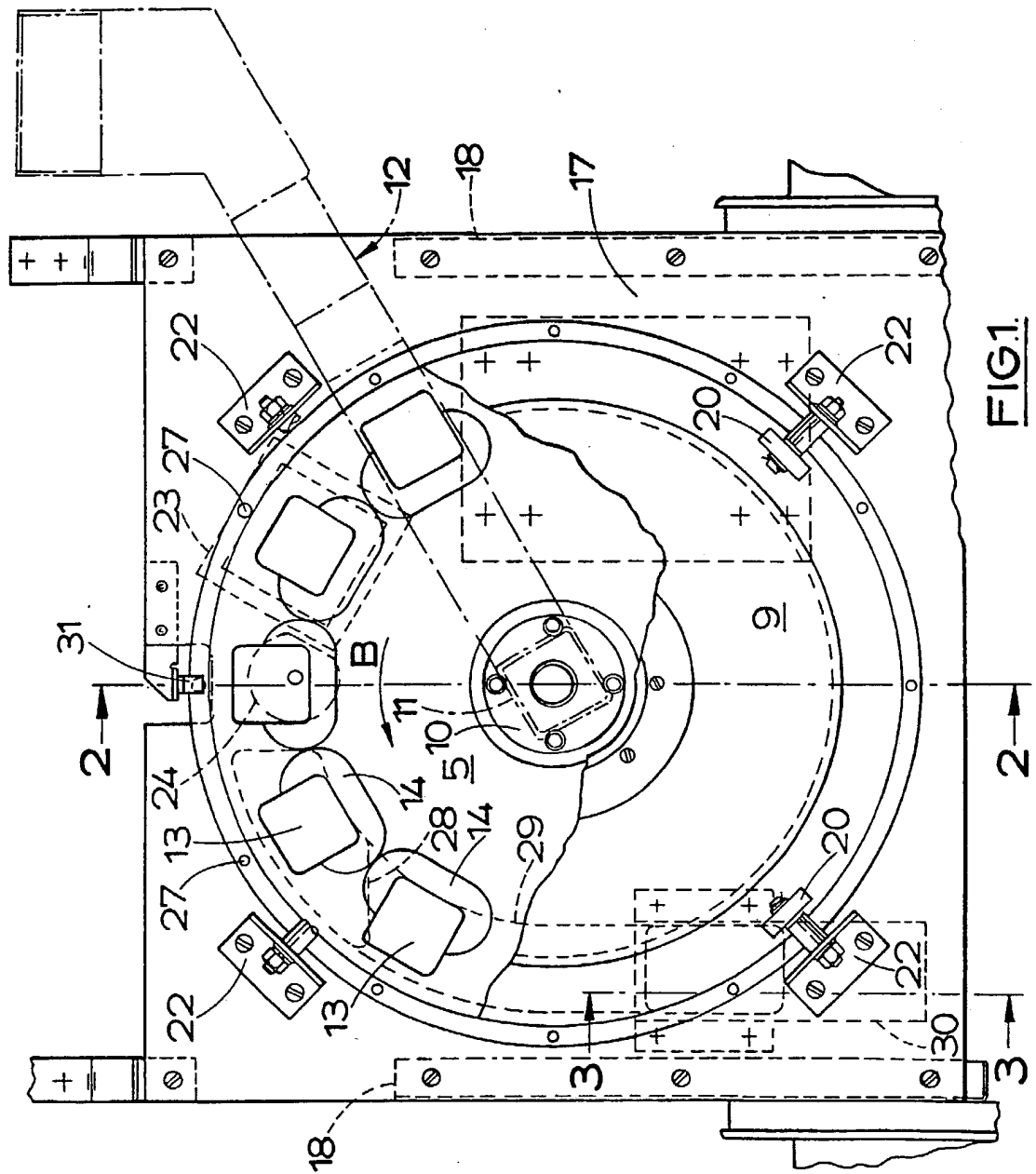
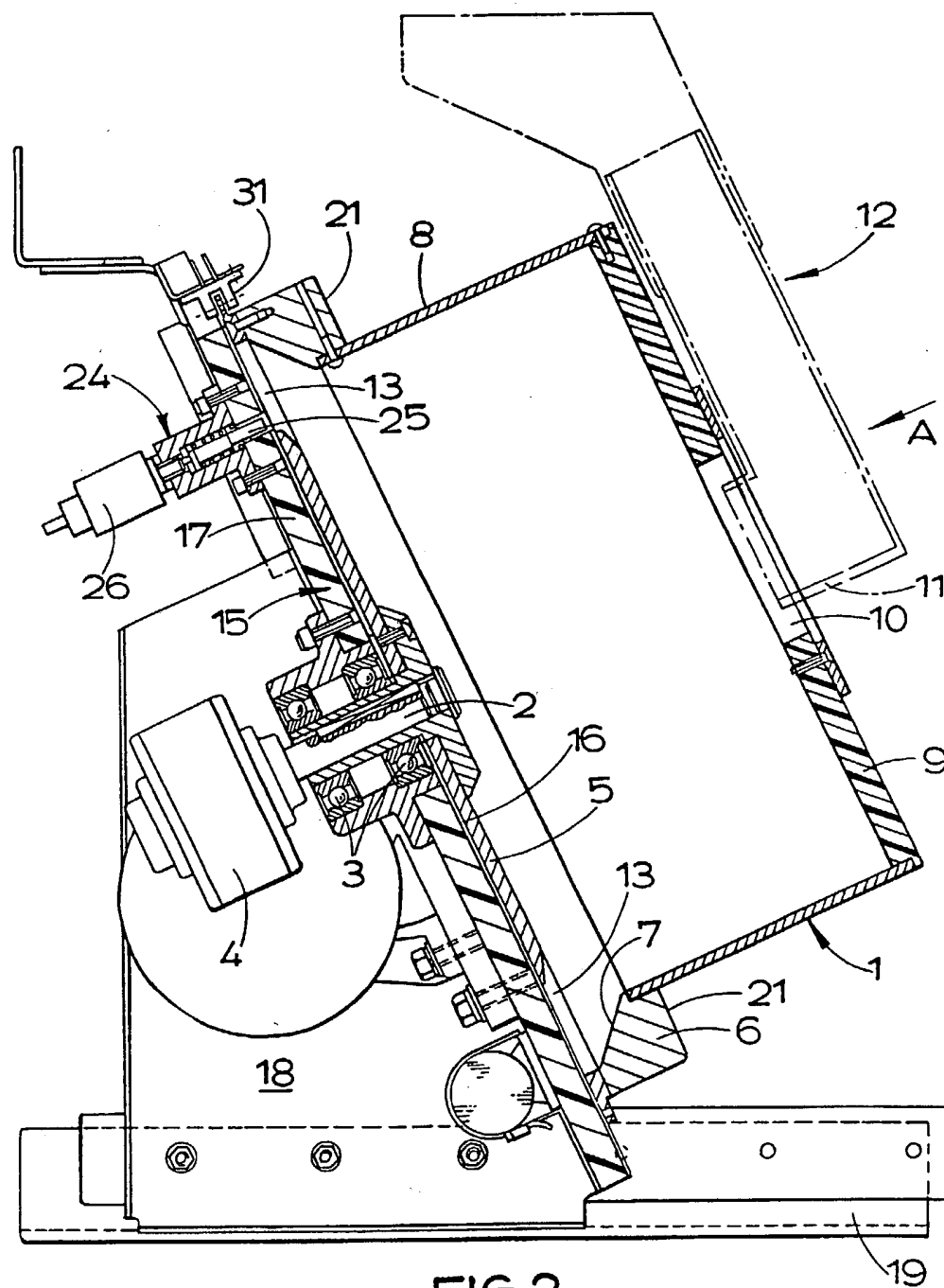
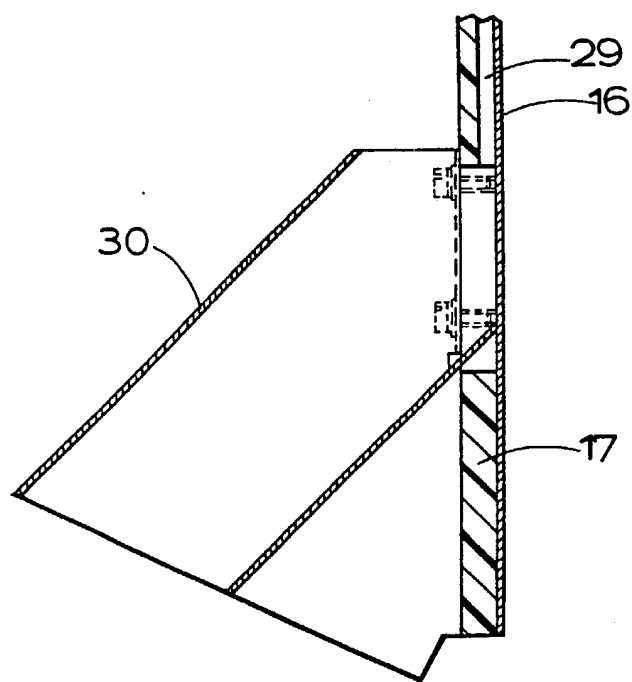


FIG. 1

FIG. 2.

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FIG. 3

COIN DISPENSERS

5 This invention relates to coin dispensers of the kind comprising a hopper from which coins are conveyed by a transport means, such as a hopper disc. This invention also relates to coin dispensing devices provided with such a coin dispenser such as change givers, vending machines with a change-giving facility and gaming machines such as fruit machines.

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The term "coin" is intended to include a token, bogus coin, and the like.

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A first aspect of the invention stems from some work on change giving machines.

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Change giving devices often need to be capable of operating with a supply of mixed coins of which the composition varies. For example, in a vending machine having a change-giving facility the machine user can insert various mixtures of coins which approximate to the total value of the goods being purchased. Some of those coins can be used to supply the change giving mechanism whilst the surplus will be retained in a cash box in the machine. It is the usual practice for the change-giving mechanism of such a machine to incorporate several coin dispensing units, usually of the stack-tube type, appropriate to the different denominations of coin which can be used to make up the change, and in order to feed the different units such devices include a coin sorting mechanism for sorting the coins inserted into the machine.

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The use of a coin sorting device and several coin dispensing units is relatively expensive, and often leads to a very bulky mechanism which, although

suitable for many purposes, cannot easily be incorporated in a relatively small machine.

According to the first aspect of the invention a
5 coin dispensing device comprises a hopper for holding
a batch of coins of mixed denomination, a coin
transport means which is arranged to pick out coins of
the different denominations from the batch and feed
them in serial manner past a coin discriminator,
10 selection means for directing selected coins from the
coin transport means after measurement by the coin
discriminator to a coin dispensing outlet and for
returning other coins to the batch, and electronic
control means arranged to provide an electrical control
15 signal to the selection means for determining which
coins from the coin transport means are directed to, or
permitted to pass to, the outlet in response to a
command signal specifying an amount of money to be
dispensed.

20
Since the coin transport means is used both in
assessing the denominations of the coins carried by it
and for conveying coins towards the coin outlet, the
bulk and complexity of the machine can be reduced,
25 particularly when the invention is applied to a change
giver.

Of course, in most circumstances the total value
of the coins which are received by the hopper will be
30 more than the total of that dispensed as change, or as
winnings in a gaming machine, and there is therefore a
need to direct surplus coins to a cash box. It is
known to vary the composition of the change in
dependence on the mix of coin denominations received by
the machine. If the coins received by the hopper have
35 passed through a coin discriminator, then the control

means may already possess an analysis of the coins received by the hopper. Otherwise, it is a preferred feature of the invention that the readings taken by the coin discriminator associated with the coin transport system may be used to provide a statistical analysis of
5 hopper content.

If desired the coin transport system may be arranged to run in one mode of the machine without any,
10 or many, coins being directed to, or being allowed to pass to the coin outlet, the coins being returned to the batch by the coin transport means, or by an ejector mechanism, to enable an analysis of the make-up of coins in the hopper to be made.

15 The coin transport means is preferably a rotating coin disc of the well known type provided with recesses or pockets around its periphery to pick out the coins from the batch of coins lying in the hopper, the disc
20 being inclined in use to the horizontal.

In a preferred embodiment the hopper is a rotatable cylindrical drum with its axis inclined slightly to the horizontal. The base of the drum
25 constitutes the coin disc, and coins are fed to the drum through a tube which projects into an axial opening in the opposite end of the drum. The tube can be made a close fit in the opening, whilst permitting free rotation of the drum, and this arrangement can
30 resist pilfering of coins from the drum which might otherwise happen in some situations.

The coin discriminator may be of any convenient type, such as an electromagnetic discriminator.

35 In a preferred embodiment the discriminator is positioned at the 11 o'clock position of a fixed

back-plate to the disc. A coin ejector operated by a solenoid is positioned at the 12 o'clock position, and a coin take-off means in the form of an aperture in a back-plate to the disc is positioned at the 1 o'clock position (the clock positions are given on the basis that the disc is viewed from the side which rotates clockwise).

Preferably the control means is arranged to provide a mode of operation in which the coin ejector is operated continuously to return all the coins to the batch when the coin transport means is being run, to provide an assessment of the make-up of the coins in the hopper.

The coins removed from the coin transport means by the coin take-off means can then be directed either to the dispensing outlet or to the cash box in dependence upon the position of a pivoted coin directing flap controlled by a solenoid under the control of the control means.

The coin transport means could be other than a disc, such as a belt-conveyor mechanism.

The first aspect of the invention may be used to provide a coin payout mechanism in a gaming machine.

Instead of a rotating drum the hopper assembly might comprise a fixed drum but having the rotating coin disc as its base. The coin feed to the drum could then be through a slit, which need not be on the axis of the drum.

A coin level detector is preferably provided to determine when the hopper is relatively full of coins,

and the control means is arranged to cause operation of the coin transport means and coin directing flap to cause coins, or selected amounts of coins according to denomination, to pass to a cash box, so that the amount of coins in the hopper is reduced in a controlled manner.

It will be appreciated that the various functions of the control means hereinbefore specified are conveniently determined by suitable software embodied in the control means. Such software can readily be devised by those persons skilled in the art.

Whilst the first aspect of the invention can be used in a change giver to avoid the need for a coin sorter, that aspect of the invention can also be used with advantage in conjunction with a coin sorter in some circumstances. For example, the coin dispensing outlet can be connected to the inlet of a passive coin sorter, such as a sorter of the inclined rail type. When thus used the control means can be arranged to control the batching of sorted coins since the discriminator output can be used to count the numbers of coins of different denominations. When a batch of coins of one type has been completed the control means can arrange for coins of that type to be returned by the selection means back to the hopper whilst batching of other coin denominations continues.

According to a second aspect of the invention a coin hopper assembly comprises a rotatable cylindrical drum adapted to be positioned in use with its axis inclined to the horizontal, drive means for rotating the drum, the base of the drum being provided with a series of circumferentially spaced apertures for receiving coins and arranged such that coins inserted

into the drum are picked up in the apertures and carried round by the drum base, a non-rotatable back-plate positioned against the drum base to support, in use, coins being carried round with the drum in the apertures, a coin delivery aperture in the back-plate with which the apertures in the drum base come into register in the course of rotation of the drum, the end wall of the drum opposed to the base being formed with a central coin supply aperture, and a coin supply tube adapted to project in use into the supply aperture.

Such a hopper assembly, in addition to its use in conjunction with the first aspect of the invention, may be used to feed coins to a coin sorting device, for example to enable coins to be batched. Thus, for example, the coin sorting device could be of the inclined rail type, the upper end of the inclined rail being positioned to receive coins which pass through the delivery aperture. In sorters of the inclined rail type coins roll down the rail and fall off or are deliberately deflected at different positions along the rail in dependence upon their denomination. The inclined rail sorter may thus be of the passive or active kinds.

A coin hopper assembly in accordance with the invention will now be described, by way of example only, with reference to the accompanying drawings in which:-

Figure 1 is a front elevation of the hopper assembly looking on the axis of the drum, in the direction of the arrow A in Figure 2, and with the upper portion of the drum end plate cut away;

Figure 2 is a vertical cross-section of the hopper assembly on the line 2-2 of Figure 1; and

Figure 3 is an enlarged section on the line 3-3 of Figure 1 showing the coin delivery chute.

5 With reference to Figure 2, a cylindrical hopper drum 1 is mounted on a drive shaft 2 journaled in bearings 3 for rotation by a drive motor 4. The drum comprises a circular end plate 5 secured to an annular guide member 6 presenting an internal frusto-conical guide surface 7, a cylindrical body 8 secured at one
10 end to the guide member 6 and at its other end to a closure plate 9 provided with a central circular supply hole 10 into which projects the lower end 11 of a coin supply tube unit 12, indicated in broken outline.

15 This construction of drum readily facilitates the choice in manufacture of the drum capacity, since it is simply necessary to choose a cylindrical member 8 of a different length to alter the drum capacity.

20 Pilfering of coins from the drum is also resisted by the relatively close fit of tube end 11 in hole 10.

The lower end plate 5 is formed as a hopper disc of substantially conventional shape, being provided
25 with a series of circumferentially spaced coin receiving apertures 13, the upper surface of plate 5 being chamfered in known manner in regions 14 in adjacent to the apertures 13 to assist in separating superimposed coins. End plate 5 is supported by a
30 drive shaft 2 in close proximity to a fixed back-plate assembly 15 comprising a circular stainless steel lamina 16 secured to the surface of a main back-plate 17 of square outline. The main back-plate 17 is supported in an inclined position in
35 use, as in Figure 2, by a pair of spaced side plates 18 on respective horizontal rails 19.

In order to assist in the rotational support of the drum 1, four rollers 20 are provided (only the lower two being shown in Figure 1) to engage with the outer surface 21 of guide member 6, the rollers 20 being carried by respective brackets 22 secured to the back-plate assembly 15.

The counter-clockwise direction of rotation of the drum 1 in Figure 1 is indicated in that Figure by arrow B. At the 11 o'clock position, as viewed from that side of disc 5 which is rotating clockwise i.e. from the underside, a coil assembly 23 is mounted in the back-plate assembly 15 as part of an inductive coin discriminator unit for testing the coins as they are carried past the 11 o'clock position in apertures 13. The coin discriminator unit will not be further described since many suitable units are known in the art. It will be appreciated that, in use, a batch of coins will fill the lower part of the drum 1 and, in well known manner, coins will be picked out of the batch by the disc 5 to be carried round with the disc in the apertures 13, the coins in the apertures 13 lying in sliding contact with the lamina 16. The apertures 13 are sized to accommodate the full range of coins to be handled.

At substantially the 12 o'clock position a solenoid-operated coin ejector assembly 24 is provided for the purpose of permitting ejection of a coin from a registering aperture 13 when it is desired to return that coin to the batch in the lower part of the drum, rather than permitting it to pass to a coin outlet 30. The assembly, 24 comprises an ejector pin 25 which is projectable from its retracted position shown in Figure 2 into an aperture 13 by a solenoid 26, the solenoid being controlled to retract the pin 25 again

before the aperture 13 has passed the pin 25.

In order to assist in timing the pulse to solenoid 26 when it is desired to eject a coin from disc 5, the periphery of the disc is provided with a series of holes 27, each hole 27 being positioned adjacent to a corresponding aperture 13, and a photo-electric detector unit 31 straddles the disc edge at the 12 o'clock position to detect when a hole 27, and thus its associated aperture 13, is in the 12 o'clock position.

An arcuate portion of the lamina 16 is cut-away substantially at the 1 o'clock position to provide a generally trapezoidal delivery opening 28 leading into an arcuate passage 29, shown in Figure 3, defined by an arcuate slot in the main back-plate 17, the arcuate slot being closed at its front by the lamina 16 to prevent coins in the batch entering passage 29. As shown in Figure 3 passage 29 leads into the coin outlet 30 in the form of a sheet metal delivery chute of rectangular cross-section.

The illustrated hopper assembly can be used to perform various functions, as discussed previously. When the hopper assembly is incorporated in a change giver the control means is suitably programmed to ensure that the correct quantity of change is delivered to the outlet 30. When there is a demand for a certain value of change that value is recorded in the memory of the control means, the drum motor 4 is energised to rotate the drum and the values of coins are determined by the discriminator 23 as they are carried round past the discriminator 23 by the disc 5. A sufficient number and value of coins to make up the recorded change value is then permitted to pass to the delivery

opening 28. This procedure may involve the rejection of some large value coins by operation of the solenoid 26, particularly when the total amount of the change coins is approaching the required change value, or when the required change value is relatively small. It will be appreciated that the software can readily arrange for a current aggregate value of the change coins to be computed as each coin is passed for delivery or rejection, and the current aggregate value is compared with the required change amount to determine the shortfall which is then made up by subsequent coins.

The software can be arranged to provide for a periodic operation of the hopper assembly so as to provide a statistical analysis of the batch of coins in the hopper drum. In this mode of operation the solenoid 26 is operated for each coin such that all coins which are carried round by the disc for assessment by the discriminator 13 are returned to the hopper. The results of such an analysis can then be used to adjust the composition of the coins in the change dispensed. For example, if it is found that there are relatively few five pence pieces in the batch, but many two pence and one pence pieces, the software could arrange for the appropriate numbers of two pence and one pence coins to be delivered as change in preference to five pence coins, which would then be ejected from disc 5 by solenoid pin 25, even though a five pence piece could have been utilised to make up the desired amount of change.

The change giver may be arranged in some applications to produce a fixed amount of change. For example, in an amusement arcade it may be desired to dispense one pounds worth of change following insertion

of a one pound coin into a slot in the change giver. In such applications the coin outlet 30 may lead to an escrow device where the change is held prior to delivery to the customer. With such an arrangement the
5 escrow may have been charged with change by the hopper assembly prior to insertion of the pound coin into the change giver slot.

10 In one particular application of change giver the coin supply tube 12 is supplied with coins by a conveyor assembly leading from a series of adjacent vending, gaming or other coin acceptance machines, surplus coins in the machines being directed to the conveyor assembly.

15 The illustrated hopper may with advantage be employed in conjunction with a coin sorter used to batch coins. The coin sorter would be fed from the outlet 30, and could, for example, be of the inclined
20 rail type. In batching coins the discriminator 23 provides a measurement of the coin type, so that the control means can maintain a record of how many coins of each type have been directed to the coin sorter. Those recorded figures can be compared with target
25 batch amounts, and when a target is reached for any particular coin denomination, indicating that a batch will be complete when the last few coins have made their way through the sorter, it is arranged that the solenoid 26 is operated to prevent any further coins of
30 that denomination passing to the coin sorter.

An advantage of this arrangement is that batching of other coin denominations can continue whilst the completed batch is awaiting removal and is dealt with.

CLAIMS

1. A coin dispensing device comprising a hopper for
5 holding a batch of coins of mixed denomination, a coin
transport means arranged to pick out coins of the
different denominations from the batch and feed them in
serial manner past a coin discriminator, the coin
10 discriminator having an electrical output, selection
means for directing selected coins from the coin
transport means after measurement by the coin
discriminator to a coin dispensing outlet and for
returning other coins to the batch, and programmed
15 electronic control means responsive to the electrical
output of the coin discriminator and arranged to
provide an electrical control signal to the selection
means for determining which coins from the coin
transport means are directed to, or permitted to pass
20 to, the outlet in response to a command signal
specifying an amount of money to be dispensed.
2. A device as claimed in Claim 1 in which the
control means stores a measure of the composition of
the mix of coins in the batch, and the stored measure
25 is used by the control means to influence the operation
of the selection means so as to vary the composition of
coins directed to the dispensing output in dependence
upon the composition of coins in the batch.
3. A device as claimed in Claim 2 in which the device
30 is operable in a mode in which the coin transport means
is run but the selection means is arranged to return
substantially all coins to the batch, in order to
provide the control means with said measure by
35 analysing the output of the coin discriminator.

4. A device as claimed in Claim 2 in which said measure is derived from the output of a coin validator associated with the device, coins which are inserted into the coin validator being led into the hopper.

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5. A device as claimed in Claim 1 in which the coins from the coin dispensing outlet are fed to a coin sorter, and the control means is arranged such that during batching of sorted coins the selection means is arranged to return coins of a given denomination back to the hopper when the control means has determined from the output of the discriminator that the correct number of coins of that denomination to complete the batch has been directed to the sorter, the control means permitting the continued running of the coin transport means to continue batching of coins of at least one other denomination.

6. A device as claimed in any of the preceding claims in which the coin transport means is a rotatable disc with apertures around its periphery for picking up coins in use from the batch of coins in the hopper.

7. A device as claimed in Claim 6 in which the hopper comprises a cylindrical drum of which the disc forms one end.

8. A device as claimed in Claim 7 in which the opposite end of the drum to the disc is provided with a central aperture into which projects a coin supply tube.

9. A device as claimed in any of the preceding claims in which the discriminator comprises an electrical coil positioned adjacent to the coin transport means for inductive linking with a coin being carried by the transport means.

10. A device as claimed in any of the preceding claims in which a timing signal for operating the selection means is derived from timing marks associated with the disc.

5

11. A coin hopper assembly substantially as described with reference to the accompanying drawings.

12. A device as claimed in Claim 1 in which the control means is arranged to operate substantially as described.

13. A coin hopper assembly comprising a rotatable cylindrical drum adapted to be positioned in use with its axis inclined to the horizontal, drive means for rotating the drum, the base of the drum being provided with a series of circumferentially spaced apertures for receiving coins and arranged such that coins inserted into the drum are picked up in the apertures and carried round by the drum base, a non-rotatable back-plate positioned adjacent to the drum base to support, in use, coins being carried round with the drum in the apertures, a coin delivery aperture in the back-plate with which the apertures in the drum base come into register in the course of rotation of the drum, the end wall of the drum opposed to the base being formed with a central coin supply aperture, and a coin supply tube adapted to project in use into the supply aperture.

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